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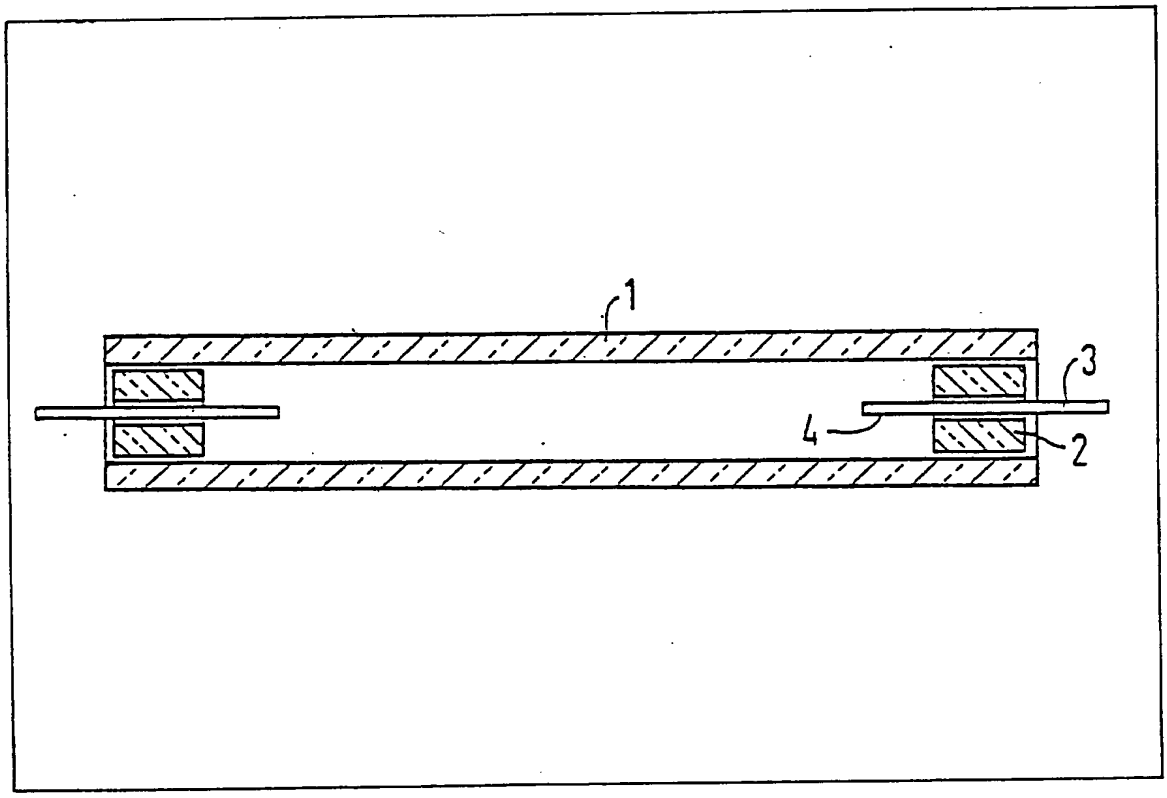
(54) **Gas discharge lamp**

(57) A gas discharge lamp, in particular a flash tube, comprises a glass tube (1), hollow cylindrical intermediate members (2) made of glass or ceramic located in the respective ends of the tube (1) and fused thereto over their entire outer cylindrical surfaces, and electrodes (4) spaced apart within the tube and having respective supply leads (3) passing through and fused into the intermediate members (2), the intermediate members consisting of a material having a fusion temperature range below that of the tube (1) and a high viscosity on fusion. As particularly described the tube (1) is of conventional hard glass and the intermediate members (2) are of soldering glass, examples of fusion range and viscosity being specified. Preferably the expansion coefficients of the glass tube (1) and the intermediate members (2) are matched.



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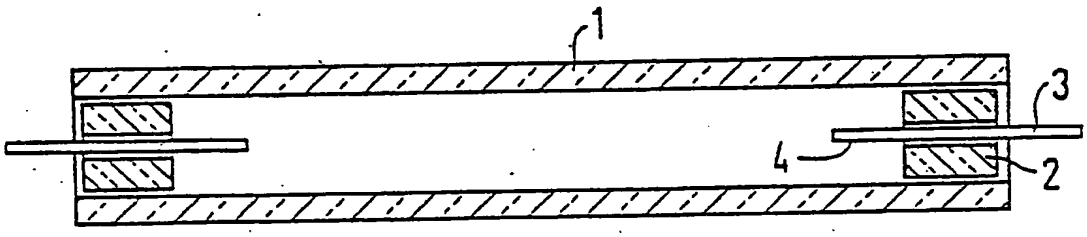
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SPECIFICATION

Gas discharge lamp

The present invention relates to a gas discharge lamp, in particular a flash tube, comprising a glass tube and electrodes having current supply leads, the current supply leads being fused into intermediate members, which are themselves inserted into the ends of the glass tube.

In German Patent Specification No. 27,13,702, such a tube is disclosed in which each intermediate member is made of sintered glass and has a conical transition portion which is inserted into an end of the glass tube and then connected to the glass tube in vacuum-tight fashion, for example, by means of a glass solder. The connection is always carried out at the end faces of the glass tube by means of seperately supplied glass solder. In this construction, particular attention has to be paid to ensuring that the coefficient of thermal expansion is matched to that of the sealed-in connecting wire. Thus, for this reason, it is proposed in the Specification to use an intermediate member which, for example, consists of layers having different coefficients of thermal expansion.

It is an object of the present invention to provide a gas discharge lamp of simpler and more economic construction than lamps previously described, but which does not suffer from any decrease in reliability.

According to the invention, there is provided a gas discharge lamp comprising a glass tube, respective hollow cylindrical intermediate members located in said tube at respective ends thereof and fused to said tube over the whole of their outer cylindrical surfaces, and electrodes spaced apart within said tube having respective current supply leads passing through and fused into respective intermediate members, said intermediate members being made of a glass or ceramic material which has a lower fusion range than that of said glass tube and has a high viscosity on fusion.

Various types of glass, for example, soldering glasses, which are commercially available, are suitable as materials for the intermediate members, provided they meet the criteria set out above. When materials meeting these criteria are used, a larger tolerance is possible when matching the coefficients of thermal expansion of the glass tube, the intermediate members and the current supply leads.

Particularly when using a glass tube made of a brittle glass, the coefficient of thermal expansion of the glass tube is advantageously matched to that of the intermediate member in order to prevent cracking of the glass tube. On fusion, the material of the intermediate member preferably has a viscosity of from 10^5 to 10^6 dPa.s. With these values, no inadmissible deformation or flowing away of the intermediate member occurs during the fusion step. The fusion temperature of the intermediate member advantageously lies below the Curie temperature of the current supply leads. Mechanical stresses, which might be produced during cooling after the fusion step, are thus largely avoided because the wire materials in question would only undergo a relatively large elongation when the Curie temperature has been exceeded.

The current supply leads can advantageously be made of a nickel - iron or nickel - iron - cobalt alloy; the intermediate member should then have a fusion temperature range of from 400°C to 450°C. Even when such relatively inexpensive alloys are used, efficient flash tubes in accordance with the invention which have a long life, can be produced.

If the flash tube is to be subjected to high thermal stresses the use of current supply leads made of tungsten is recommended, the intermediate members then having a fusion temperature range of 500°C to 600°C.

When such materials are used for the intermediate members and the supply leads, the gas discharge lamp can be produced in an extremely simple manner, by inserting intermediate members in the form of sleeves into the respective ends of a glass tube, passing the current supply leads through the respective sleeves and fusing all the components together over the whole of their contacting surfaces in a single heating step. This method results in durable vacuum-tight connections, and bursting of the flash tubes as a result of mechanical stresses does not occur. Moreover, the method makes it possible for the electrode spacing to be adjusted prior to the fusing in of the last electrode and to be maintained constant during the fusion step. This cannot be realised to the same extent when fusing intermediate members in the form of end pieces onto the end faces of a tube.

An accurate positioning of the sleeves in the glass tube is not a significant factor in the case of the invention. The material used for the glass tube is not important either; the standard hard glass, which is conventionally used in flash tubes, may be used.

The present invention has the advantage that the coefficient of thermal expansion of the intermediate members can be selected to match that of the glass tube, because accurate matching of the former with the coefficient of thermal expansion of the current supply lead is not necessary. A connecting wire or a cylindrical pin can conveniently be used as a current supply lead.

The invention will now be further described with reference to the drawing, which is a schematic side-sectional view of a gas discharge lamp in accordance with the invention.

Referring to the drawing, intermediate members 2 in the form of sleeves are inserted into the ends of a glass tube 1 which is preferably made of a hard glass such as is conventionally used for flash tubes. Current supply leads 3 for electrodes 4 are passed through the intermediate members 2. The exact position of the intermediate members 2 in the tube is not significant; the electrodes 4, however, can be readily fixed with precision at the required mutual spacing before fusion is effected between the neighbouring surfaces of the hard glass tube 1, the intermediate members 2 and the current supply leads 3. This fusion is effected simultaneously by means of a single heating step to an appropriate temperature.

The intermediate members must, of course, be of a material which meets the required criteria, i.e. must have a lower fusion range than the glass tube and have a high viscosity during the fusion step.

The constructi n described is also particularly suitable for the simultaneous heat treatment of a large number of discharge lamps, where the individual tubes rest on their end faces in a device and are first sealed at ne end.

CLAIMS

1. A gas discharge lamp comprising a glass tube, respective hollow cylindrical intermediate members located in said tube at respective ends thereof and fused to said tube over the whole of their outer cylindrical surfaces, and electrodes spaced apart within said tube having respective current supply leads passing through and fused into respective intermediate members, said intermediate members being made of a glass or ceramic material which has a lower fusion range than that of said glass tube and has a high viscosity on fusion.

2. A gas discharge lamp as claimed in Claim 1, wherein the coefficient of thermal expansion of the material of said intermediate members is matched to that of the glass tube, but may differ from the coefficient of thermal expansion of the current supply leads.

3. A gas discharge lamp as claimed in Claim 1 or Claim 2, wherein, on fusion, the material of the intermediate members has a viscosity of 10^5 dPa.s to 10^6 dPa.s.

4. A gas discharge lamp as claimed in any one of Claims 1 to 3, wherein said intermediate members are made of soldering glass.

5. A gas discharge lamp as claimed in any one of the preceding Claims, wherein said intermediate members have a fusing temperature range which is below the Curie temperature of the current supply leads.

6. A gas discharge lamp as claimed in Claim 5, wherein said current supply leads are made of a nickel - iron or nickel - iron - cobalt alloy, and said intermediate members have a fusion temperature range of 400°C to 450°C.

7. A gas discharge lamp as claimed in any one of Claims 1 to 4, wherein said current supply leads are made of tungsten, and said intermediate members have a fusion temperature range of 500°C to 600°C.

8. A gas discharge lamp substantially as hereinbefore described with reference to and as shown in the drawing.

9. A flash tube as claimed in any one of Claims 1 to 7.

10. A method of producing a gas discharge lamp as claimed in any one of Claims 1 to 7, comprising the step of inserting cylindrical sleeves made of glass or ceramic into the respective ends of a glass tube to form said intermediate members, passing respective electrode current supply leads through said sleeves, and subjecting the assembly to heating so that fusion between the components over their adjoining surfaces is simultaneously effected.

11. A method as claimed in Claim 10, wherein mutual spacing between electrodes connected to said supply leads, is adjusted prior to the heating step and is maintained constant during the heating step.

12. A method of producing a gas discharge lamp substantially as hereinbefore described with reference to the drawing.

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